

SEQUENCE LISTING



<110> Lo, Reggie Y.C.
Schryvers, Anthony B.
Potter, Andrew A.

<120> TRANSFERRIN BINDING PROTEINS OF
PASTEURELLA HAEMOLYTICA AND VACCINES CONTAINING SAME

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<140> 08/753,750

<141> 1996-11-29

<150> US 60/008,569

<151> 1995-12-01

<150> CA 2,164,274

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84

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86

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88

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35 40 45
Thr Glu Ser His Tyr Ala His Glu Arg Gln Asn Glu Val Thr Gly Leu
50 55 60
Gly Lys Val Val Lys Asn Tyr His Glu Met Ser Lys Asn Gln Ile Leu
65 70 75 80
Gly Ile Arg Asp Leu Thr Arg Tyr Asp Pro Gly Ile Ser Val Val Glu
85 90 95
Gln Gly Arg Gly Ala Ser Ser Gly Tyr Ala Ile Arg Gly Val Asp Lys
100 105 110
Asn Arg Val Ser Leu Leu Val Asp Gly Leu Pro Gln Ala His Ser Tyr
115 120 125
His Thr Leu Ser Gly Asp Ala Asn Gly Gly Ala Ile Asn Glu Ile Glu
130 135 140
Tyr Glu Asn Ile Arg Ser Ile Glu Leu Ser Lys Gly Ala Ser Ser Ala
145 150 155 160

90

Glu	Tyr	Gly	Ser	Gly	Ala	His	Gly	Gly	Ala	Ile	Gly	Phe	Arg	Thr	Lys
				165					170						175
Asp	Ala	Gln	Asp	Ile	Ile	Lys	Glu	Gly	Gln	His	Trp	Gly	Leu	Asp	Ser
			180					185					190		
Lys	Thr	Ser	Tyr	Ala	Ser	Lys	Asn	Ser	His	Phe	Leu	Gln	Ile	Ala	Ala
		195					200					205			
Ala	Gly	Glu	Ala	Gly	Gly	Phe	Glu	Ala	Leu	Val	Ile	Ala	Thr	His	Arg
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His	Gly	Lys	Glu	Thr	Lys	Ile	His	Ser	Glu	Ala	Asn	Lys	Leu	Lys	His
225					230					235					240
Asn	Ile	Arg	Arg	Ile	Thr	Gly	Phe	Glu	Asn	Arg	Tyr	Asp	Phe	Thr	Gln
				245					250					255	
Ile	Pro	His	Arg	Met	Pro	Pro	Gly	Gly	Ser	Phe	Phe	Ile	Val	Glu	Asp
			260					265					270		
Thr	Cys	Pro	Thr	Leu	Asp	Cys	Thr	Pro	Arg	Ala	Arg	Val	Lys	Leu	Asn
		275					280					285			
Arg	Asp	Asn	Phe	Pro	Val	Arg	Thr	Phe	Pro	Glu	Tyr	Thr	Pro	Glu	Glu
	290					295					300				
Arg	Asn	Ala	Glu	Gln	Ile	Pro	Tyr	Arg	Thr	Glu	Gln	Leu	Ser	Ala	Gln
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Glu	Lys	Thr	Gly	Lys	Asp	Arg	Ile	Ala	Pro	Asn	Pro	Leu	Asp	Tyr	Lys
				325					330					335	
Ser	Asn	Ser	Val	Phe	Met	Lys	Phe	Gly	Tyr	His	Phe	Asn	Ser	Ser	His
			340					345					350		
Tyr	Leu	Gly	Ala	Ile	Leu	Glu	Asp	Thr	Lys	Gln	Arg	Thr	Ile	Ser	Val
		355					360					365			
Ile	Cys	Lys	Arg	Gln	Leu	Thr	Ile	Gln	Lys	Thr	Ile	Leu	Thr	Tyr	His
	370					375					380				
Leu	Gly	Thr	Met	Phe	Met	Lys	Gly	Ile	Ile	Phe	Arg	Trp	Leu	Ser	Val
385					390					395					400
Gln	Ala	Lys	Asp	Pro	Leu	Trp	Val	Ala	His	Met	Pro	Cys	Glu	Val	Asp
				405						410				415	
Glu	Arg	His	His	Lys	Arg	Arg	Leu	Gly	Phe	Thr	Tyr	Lys	Tyr	Lys	Pro
				420				425					430		
Glu	Asn	Asn	Arg	Trp	Leu	Asp	Ser	Ile	Asn	Ser	Cys	Val	Arg	Ala	Leu
		435					440					445			
Arg	Ser	Arg	Cys	Cys	Ala	Leu	Ser	Lys	Gln	Asp	Ile	Glu	Leu	Tyr	Ser
	450					455					460				
Arg	Leu	His	Arg	Leu	His	Cys	Ser	Asp	Tyr	Pro	Val	Val	Asp	Lys	Asn
465					470					475					480
Cys	Gly	Pro	Thr	Leu	Asp	Lys	Ser	Trp	Ser	Met	Tyr	Arg	Thr	Glu	Arg
				485					490					495	
Asn	Asn	Tyr	Gln	Glu	Lys	His	Arg	Val	Ile	His	Leu	Glu	Phe	Asp	Leu
			500					505					510		
Ala	Leu	Asn	Ala	Gly	Gln	Gly	Val	Phe	Leu	Gln	Thr	His	Lys	Leu	Asn
		515					520					525			
Leu	Gly	Leu	Gly	Phe	Glu	Ser	Ile	Asn	Ser	Leu	Met	Asp	His	Gly	Asp
	530					535					540				
Met	Thr	Ala	Gln	Tyr	Thr	Leu	Gly	Arg	Leu	Tyr	Gln	Leu	Pro	Arg	Arg
545					550					555					560
Asp	Pro	Arg	Ser	Ile	Trp	Thr	Val	Ser	Leu	Cys	Asn	Asn	Thr	Arg	Ala
				565					570					575	
Thr	Leu	Asn	Cys	Asp	Ala	Leu	Asn	Leu	Gly	Ile	Arg	Leu	Tyr	Leu	Arg

Cys	Cys	Leu	580	Asn	Gln	Leu	585	Asn	Pro	Arg	Tyr	Gly	590	Ser	Val	Leu
		595	Ile				600					605				
Phe	Gln	Phe	Gly	Thr	Arg	Val	His	Arg	Thr	Trp	Thr	Pro	Thr	Ser	Leu	
	610					615						620				
Gly	Glu	Leu	Pro	Ser	Ile	Arg	Ala	Met	Ala	His	Tyr	Val	Asn	His	His	
625					630					635					640	
Pro	Asn	Gln	Val	Phe	Trp	Gly	Arg	Gly	Ala	Val	Lys	His	Leu	Thr	Leu	
				645					650						655	
Leu	Ser	Ser	Pro	Trp	Met	Leu	Lys	Phe	Ala	Ala	Ser	Gly	Arg	His	Val	
			660					665					670			
Thr	Leu	Ser	Val	Ile	Ser	Gly	Ala	Thr	Asp	Arg	Phe	Leu	Val	Pro	Pro	
		675				680						685				
Leu	Ile	Leu	Thr	Gly	Val	Asn	Tyr	Lys	Asn	Glu	Ser	Tyr	Val	Ser	Ala	
	690					695					700					
Ile	Tyr	Asn	Val	Asp	Val	Arg	Tyr	Cys	Lys	Thr	Leu	Tyr	Tyr	Arg	Gly	
705					710					715					720	
Gln	Gln	Leu	Gly	Asp	Arg	Ala	Thr	Gly	Gln	Ala	Lys	Pro	Asp	Gly	Tyr	
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Gln	Leu	His	Arg	Phe	Ala	Ala	Pro	Gly	Arg	Asn	Phe	Ser	Tyr	His	Ser	
			740					745					750			
Lys	Lys	Phe	Arg	Pro	Ala	Lys	Glu	Asn	Thr	Lys	Asn	Ala	Glu	Ser	Ile	
		755					760					765				
Phe	Ser	Ala	Phe	Phe	Val	Gly	Ser	Asn	Gly	Leu	His	Thr	Asn	Ser	Lys	
	770					775					780					
Ser	Cys	Phe	Asn	Gly	Arg	Leu	His	Glu	Pro	Ile	Pro	Tyr	Phe	Phe	Asn	
785					790				795						800	
Phe	Leu	Arg	Asn	Val	Pro	Arg	Phe	Asn	Glu	Tyr	His	Cys	Cys	Cys	Thr	
			805						810					815		
Ser	Leu	Ile	Ala	Ala	Ser	Ile	Leu	Leu	His	His	Ile	Tyr	His	Trp	Val	
			820					825					830			
Phe	Asp	Phe	Arg	Tyr	Tyr	Tyr	Phe	Val	Tyr	Phe	Cys	Trp	Ile	Leu	His	
		835					840					845				
His	Leu	Ile	His	Ile	Asn	Ser	Phe	Leu	Met	Leu	Leu	Ser	His	Tyr	Arg	
	850				855						860					
Glu	Val	Val	Tyr	Leu	Thr	Cys	Cys	Ala	Cys	Ala	Phe	Asn	Ile	Val	Thr	
865					870					875					880	
Val	Asn	Gly	Phe	Cys	Val	Gly	Cys	Cys	Ser	Asn	Ile	Leu	Ala	Glu	Met	
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Lys Phe

<210> 11

<211> 917

<212> PRT

<213> Pasteurella haemolytica

<400> 11

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Met	Thr	Ala	Leu	Pro	Ala	Tyr	Ala	Glu	Asn	Val	Gln	Ala	Gly	Gln	Ala	
			20					25					30			

92

Gln Glu Lys Gln Leu Asp Thr Ile Gln Val Lys Ala Lys Lys Gln Lys
35 40 45
Thr Arg Arg Asp Asn Glu Val Thr Gly Leu Gly Lys Leu Val Lys Thr
50 55 60
Ala Asp Thr Leu Ser Lys Glu Gln Val Leu Asp Ile Arg Asp Leu Thr
65 70 75 80
Arg Tyr Asp Pro Gly Ile Ala Val Val Glu Gln Gly Arg Gly Ala Ser
85 90 95
Ser Gly Tyr Ser Ile Arg Gly Met Asp Lys Asn Arg Val Ser Leu Thr
100 105 110
Val Asp Gly Leu Ala Gln Ile Gln Ser Tyr Thr Ala Gln Ala Ala Leu
115 120 125
Gly Gly Thr Arg Thr Ala Gly Ser Ser Gly Ala Ile Asn Glu Ile Glu
130 135 140
Tyr Glu Asn Val Lys Ala Val Glu Ile Ser Lys Gly Ser Asn Ser Val
145 150 155 160
Glu Gln Gly Ser Gly Ala Leu Ala Gly Ser Val Ala Phe Gln Thr Lys
165 170 175
Thr Ala Asp Asp Val Ile Gly Glu Gly Arg Gln Trp Gly Ile Gln Ser
180 185 190
Lys Thr Ala Tyr Ser Gly Lys Asn Arg Gly Leu Thr Gln Ser Ile Ala
195 200 205
Leu Ala Gly Arg Ile Gly Gly Ala Glu Ala Leu Leu Ile Arg Thr Gly
210 215 220
Arg His Ala Gly Glu Ile Arg Ala His Glu Ala Ala Gly Arg Gly Val
225 230 235 240
Gln Ser Phe Asn Arg Leu Ala Pro Val Asp Asp Gly Ser Lys Tyr Ala
245 250 255
Tyr Phe Ile Val Glu Glu Glu Cys Lys Asn Gly Gly His Glu Lys Cys
260 265 270
Lys Ala Asn Pro Lys Lys Asp Val Val Gly Glu Asp Lys Arg Gln Thr
275 280 285
Val Ser Thr Arg Asp Tyr Thr Gly Pro Asn Arg Phe Leu Ala Asp Pro
290 295 300
Leu Ser Tyr Glu Ser Arg Ser Trp Leu Phe Arg Pro Gly Phe Arg Phe
305 310 315 320
Glu Asn Lys Arg His Tyr Ile Gly Gly Ile Leu Glu Arg Thr Gln Gln
325 330 335
Thr Phe Asp Thr Arg Asp Met Thr Val Pro Ala Phe Leu Thr Lys Ala
340 345 350
Val Phe Asp Ala Asn Gln Lys Gln Ala Gly Ser Leu Arg Gly Asn Gly
355 360 365
Asn His Lys Tyr Ala Gly Asn His Lys Tyr Gly Gly Leu Phe Thr Ser
370 375 380
Gly Glu Asn Asn Ala Pro Val Gly Ala Glu Tyr Gly Thr Gly Val Phe
385 390 395 400
Tyr Asp Glu Thr His Thr Lys Ser Arg Tyr Gly Leu Glu Tyr Val Tyr
405 410 415
Thr Asn Ala Asp Lys Asp Thr Trp Ala Asp Tyr Ala Arg Leu Ser Tyr
420 425 430
Asp Arg Gln Gly Ile Gly Leu Asp Asn His Phe Gln Gln Thr His Cys
435 440 445
Ser Ala Asp Gly Ser Asp Lys Tyr Cys Arg Pro Ser Ala Asp Lys Pro

93

450	Phe	Ser	Tyr	Tyr	Lys	Ser	Asp	Arg	Val	Ile	Tyr	Gly	Glu	Ser	His	Lys
465	Leu	Leu	Gln	Ala	Ala	Phe	Lys	Lys	Ser	Phe	Asp	Thr	Ala	Lys	Ile	Arg
				485						490						495
	His	Asn	Leu	Ser	Val	Asn	Leu	Gly	Tyr	Asp	Arg	Phe	Gly	Ser	Asn	Leu
				500					505						510	
	Arg	His	Gln	Asp	Tyr	Tyr	Tyr	Gln	Ser	Ala	Asn	Arg	Ala	Tyr	Ser	Leu
				515					520						525	
	Lys	Thr	Pro	Pro	Gln	Asn	Asn	Gly	Lys	Lys	Thr	Ser	Pro	Asn	Gly	Arg
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	Glu	Lys	Asn	Pro	Tyr	Trp	Val	Ser	Ile	Gly	Arg	Gly	Asn	Val	Val	Thr
545						550										560
	Arg	Gln	Ile	Cys	Leu	Phe	Gly	Asn	Asn	Thr	Tyr	Thr	Asp	Cys	Thr	Pro
					565						570					575
	Arg	Ser	Ile	Asn	Gly	Lys	Ser	Tyr	Tyr	Ala	Ala	Val	Arg	Asp	Asn	Val
				580						585					590	
	Arg	Leu	Gly	Arg	Trp	Ala	Asp	Val	Gly	Ala	Gly	Leu	Arg	Tyr	Asp	Tyr
				595				600							605	
	Arg	Ser	Thr	His	Ser	Asp	Asp	Gly	Ser	Val	Ser	Thr	Gly	Thr	His	Arg
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	Thr	Leu	Ser	Trp	Asn	Ala	Gly	Ile	Val	Leu	Lys	Pro	Ala	Asp	Trp	Leu
625						630										640
	Asp	Leu	Thr	Tyr	Arg	Thr	Ser	Thr	Gly	Phe	Arg	Leu	Pro	Ser	Phe	Ala
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	Glu	Met	Tyr	Gly	Trp	Arg	Ser	Gly	Asp	Lys	Ile	Lys	Ala	Val	Lys	Ile
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	Asp	Pro	Glu	Lys	Ser	Phe	Asn	Lys	Glu	Ala	Gly	Ile	Val	Phe	Lys	Gly
					675										685	
	Asp	Phe	Gly	Asn	Leu	Glu	Ala	Ser	Trp	Phe	Asn	Asn	Ala	Tyr	Arg	Asp
					690										700	
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705						710										720
	Val	Lys	Gly	Asn	Pro	Ala	Tyr	Leu	Asn	Ala	Gln	Ser	Ala	Arg	Ile	Thr
					725						730					735
	Gly	Ile	Asn	Ile	Leu	Gly	Lys	Ile	Asp	Trp	Asn	Gly	Val	Trp	Asp	Lys
					740						745					750
	Leu	Pro	Glu	Gly	Trp	Tyr	Ser	Thr	Phe	Ala	Tyr	Asn	Arg	Val	Arg	Val
					755										765	
	Arg	Asp	Ile	Lys	Lys	Arg	Ala	Asp	Arg	Thr	Asp	Ile	Gln	Ser	His	Leu
					770										780	
	Phe	Asp	Ala	Ile	Gln	Pro	Ser	Arg	Tyr	Val	Val	Gly	Ser	Gly	Tyr	Asp
785						790										800
	Gln	Pro	Glu	Gly	Lys	Trp	Gly	Val	Asn	Gly	Met	Leu	Thr	Tyr	Ser	Lys
					805						810					815
	Ala	Lys	Glu	Ile	Thr	Glu	Leu	Leu	Gly	Ser	Arg	Ala	Leu	Leu	Asn	Gly
					820						825					830
	Asn	Ser	Arg	Asn	Thr	Lys	Ala	Thr	Ala	Arg	Arg	Thr	Arg	Pro	Trp	Tyr
					835										845	
	Ile	Val	Asp	Val	Ser	Gly	Tyr	Tyr	Thr	Val	Lys	Lys	His	Phe	Thr	Leu
					850											860
	Arg	Ala	Gly	Val	Tyr	Asn	Leu	Leu	Asn	His	Arg	Tyr	Val	Thr	Trp	Glu
865						870										880

94

Asn Val Arg Gln Thr Ala Ala Gly Ala Val Asn Gln His Lys Asn Val
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Gly Val Tyr Asn Arg Tyr Ala Ala Pro Gly Arg Asn Tyr Thr Phe Ser
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Leu Glu Met Lys Phe
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<211> 908
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<213> Pasteurella haemolytica

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Gln Glu Lys Gln Leu Asp Thr Ile Gln Val Lys Ala Lys Lys Gln Lys
35 40 45
Thr Arg Arg Asp Asn Glu Val Thr Gly Leu Gly Lys Leu Val Lys Ser
50 55 60
Ser Asp Thr Leu Ser Lys Glu Gln Val Leu Asn Ile Arg Asp Leu Thr
65 70 75 80
Arg Tyr Asp Pro Gly Ile Ala Val Val Glu Gln Gly Arg Gly Ala Ser
85 90 95
Ser Gly Tyr Ser Ile Arg Gly Met Asp Lys Asn Arg Val Ser Leu Thr
100 105 110
Val Asp Gly Val Ser Gln Ile Gln Ser Tyr Thr Ala Gln Ala Ala Leu
115 120 125
Gly Gly Thr Arg Thr Ala Gly Ser Ser Gly Ala Ile Asn Glu Ile Glu
130 135 140
Tyr Glu Asn Val Lys Ala Val Glu Ile Ser Lys Gly Ser Asn Ser Ser
145 150 155 160
Glu Tyr Gly Asn Gly Ala Leu Ala Gly Ser Val Ala Phe Gln Thr Lys
165 170 175
Thr Ala Ala Asp Ile Ile Gly Glu Gly Lys Gln Trp Gly Ile Gln Ser
180 185 190
Lys Thr Ala Tyr Ser Gly Lys Asp His Ala Leu Thr Gln Ser Leu Ala
195 200 205
Leu Ala Gly Arg Ser Gly Gly Ala Glu Ala Leu Leu Ile Tyr Thr Lys
210 215 220
Arg Arg Gly Arg Glu Ile His Ala His Lys Asp Ala Gly Lys Gly Val
225 230 235 240
Gln Ser Phe Asn Arg Leu Val Leu Asp Glu Asp Lys Lys Glu Gly Gly
245 250 255
Ser Gln Tyr Arg Tyr Phe Ile Val Glu Glu Glu Cys His Asn Gly Tyr
260 265 270
Ala Ala Cys Lys Asn Lys Leu Lys Glu Asp Ala Ser Val Lys Asp Glu
275 280 285
Arg Lys Thr Val Ser Thr Gln Asp Tyr Thr Gly Ser Asn Arg Leu Leu
290 295 300
Ala Asn Pro Leu Glu Tyr Gly Ser Gln Ser Trp Leu Phe Arg Pro Gly

95

305	Trp	His	Leu	Asp	Asn	Arg	His	Tyr	Val	Gly	Ala	Val	Leu	Glu	Arg	Thr	320
					325					330							335
Gln	Gln	Thr	Phe	Asp	Thr	Arg	Asp	Met	Thr	Val	Pro	Ala	Tyr	Phe	Thr		
			340					345						350			
Ser	Glu	Asp	Tyr	Val	Pro	Gly	Ser	Leu	Lys	Gly	Leu	Gly	Lys	Tyr	Ser		
		355					360						365				
Gly	Asp	Asn	Lys	Ala	Glu	Arg	Leu	Phe	Val	Gln	Gly	Glu	Gly	Ser	Thr		
	370					375						380					
Leu	Gln	Gly	Ile	Gly	Tyr	Gly	Thr	Gly	Val	Phe	Tyr	Asp	Glu	Arg	His		
385					390					395					400		
Thr	Lys	Asn	Arg	Tyr	Gly	Val	Glu	Tyr	Val	Tyr	His	Asn	Ala	Asp	Lys		
				405					410						415		
Asp	Thr	Trp	Ala	Asp	Tyr	Ala	Arg	Leu	Ser	Tyr	Asp	Arg	Gln	Gly	Ile		
			420						425					430			
Asp	Leu	Asp	Asn	Arg	Leu	Gln	Gln	Thr	His	Cys	Ser	His	Asp	Gly	Ser		
		435				440						445					
Asp	Lys	Asn	Cys	Arg	Pro	Asp	Gly	Asn	Lys	Pro	Tyr	Ser	Phe	Tyr	Lys		
	450					455						460					
Ser	Asp	Arg	Met	Ile	Tyr	Glu	Gln	Ser	Arg	Asn	Leu	Phe	Gln	Ala	Val		
465					470					475					480		
Phe	Lys	Lys	Ala	Phe	Asp	Thr	Ala	Lys	Ile	Arg	His	Asn	Leu	Ser	Ile		
			485						490					495			
Asn	Leu	Gly	Tyr	Asp	Arg	Phe	Lys	Ser	Gln	Leu	Ser	His	Ser	Asp	Tyr		
			500					505					510				
Tyr	Leu	Gln	Asn	Ala	Val	Gln	Ala	Tyr	Asp	Leu	Ile	Thr	Pro	Lys	Lys		
		515					520						525				
Pro	Pro	Phe	Pro	Asn	Gly	Ser	Lys	Asp	Asn	Pro	Tyr	Arg	Val	Ser	Ile		
	530					535						540					
Gly	Lys	Thr	Thr	Val	Asn	Thr	Ser	Pro	Ile	Cys	Arg	Phe	Gly	Asn	Asn		
545					550					555					560		
Thr	Tyr	Thr	Asp	Cys	Thr	Pro	Arg	Asn	Ile	Gly	Gly	Asn	Gly	Tyr	Tyr		
			565						570					575			
Ala	Ala	Val	Gln	Asp	Asn	Val	Arg	Leu	Gly	Arg	Trp	Ala	Asp	Val	Gly		
			580					585					590				
Ala	Gly	Ile	Arg	Tyr	Asp	Tyr	Arg	Ser	Thr	His	Ser	Glu	Asp	Lys	Ser		
		595					600					605					
Val	Ser	Thr	Gly	Thr	His	Arg	Asn	Leu	Ser	Trp	Asn	Ala	Gly	Val	Val		
	610						615					620					
Leu	Lys	Pro	Phe	Thr	Trp	Met	Asp	Leu	Thr	Tyr	Arg	Ala	Ser	Thr	Gly		
625					630					635					640		
Phe	Arg	Leu	Pro	Ser	Phe	Ala	Glu	Met	Tyr	Gly	Trp	Arg	Ala	Gly	Glu		
			645						650					655			
Ser	Leu	Lys	Thr	Leu	Asp	Leu	Lys	Pro	Glu	Lys	Ser	Phe	Asn	Arg	Glu		
		660						665					670				
Ala	Gly	Ile	Val	Phe	Lys	Gly	Asp	Phe	Gly	Asn	Leu	Glu	Ala	Ser	Tyr		
		675					680					685					
Phe	Asn	Asn	Ala	Tyr	Arg	Asp	Leu	Ile	Ala	Phe	Gly	Tyr	Glu	Thr	Arg		
	690					695					700						
Thr	Gln	Asn	Gly	Gln	Thr	Ser	Ala	Ser	Gly	Asp	Pro	Gly	Tyr	Arg	Asn		
705					710					715					720		
Ala	Gln	Asn	Ala	Arg	Ile	Ala	Gly	Ile	Asn	Ile	Leu	Gly	Lys	Ile	Asp		
			725						730					735			

96

Trp	His	Gly	Val	Trp	Gly	Gly	Leu	Pro	Asp	Gly	Leu	Tyr	Ser	Thr	Leu
			740					745					750		
Ala	Tyr	Asn	Arg	Ile	Lys	Val	Lys	Asp	Ala	Asp	Ile	Arg	Ala	Asp	Arg
		755					760					765			
Thr	Phe	Val	Thr	Ser	Tyr	Leu	Phe	Asp	Ala	Val	Gln	Pro	Ser	Arg	Tyr
	770				775						780				
Val	Leu	Gly	Leu	Gly	Tyr	Asp	His	Pro	Asp	Gly	Ile	Trp	Gly	Ile	Asn
785					790					795					800
Thr	Met	Phe	Thr	Tyr	Ser	Lys	Ala	Lys	Ser	Val	Asp	Glu	Leu	Leu	Gly
			805						810					815	
Ser	Gln	Ala	Leu	Leu	Asn	Gly	Asn	Ala	Asn	Ala	Lys	Lys	Ala	Ala	Ser
		820					825						830		
Arg	Arg	Thr	Arg	Pro	Trp	Tyr	Val	Thr	Asp	Val	Ser	Gly	Tyr	Tyr	Asn
		835				840					845				
Ile	Lys	Lys	His	Leu	Thr	Leu	Arg	Ala	Gly	Val	Tyr	Asn	Leu	Leu	Asn
	850					855					860				
Tyr	Arg	Tyr	Val	Thr	Trp	Glu	Asn	Val	Arg	Gln	Thr	Ala	Gly	Gly	Ala
865					870					875					880
Val	Asn	Gln	His	Lys	Asn	Val	Gly	Val	Tyr	Asn	Arg	Tyr	Ala	Ala	Pro
			885						890					895	
Gly	Arg	Asn	Tyr	Thr	Phe	Ser	Leu	Glu	Met	Lys	Phe				
		900						905							

<210> 13
 <211> 604
 <212> PRT
 <213> Pasteurella haemolytica

<400> 13															
Met	Ile	Met	Lys	Tyr	His	His	Phe	Arg	Tyr	Ser	Thr	Val	Ala	Leu	Thr
1			5						10					15	
Val	Leu	Phe	Ala	Leu	Ser	His	Ser	Tyr	Gly	Ala	Ala	Thr	Glu	Asn	Lys
		20						25				30			
Lys	Ile	Glu	Glu	Asn	Asn	Asp	Leu	Ala	Val	Leu	Asp	Glu	Val	Ile	Val
	35						40					45			
Thr	Glu	Ser	His	Tyr	Ala	His	Glu	Arg	Gln	Asn	Glu	Val	Thr	Gly	Leu
	50					55					60				
Gly	Lys	Val	Val	Lys	Asn	Tyr	His	Glu	Met	Ser	Lys	Asn	Gln	Ile	Leu
65				70					75					80	
Gly	Ile	Arg	Asp	Leu	Thr	Arg	Tyr	Asp	Pro	Gly	Ile	Ser	Val	Val	Glu
			85					90					95		
Gln	Gly	Arg	Gly	Ala	Ser	Ser	Gly	Tyr	Ala	Ile	Arg	Gly	Val	Asp	Lys
		100						105					110		
Asn	Arg	Val	Ser	Leu	Leu	Val	Asp	Gly	Leu	Pro	Gln	Ala	His	Ser	Tyr
		115					120					125			
His	Thr	Leu	Ser	Gly	Asp	Ala	Asn	Gly	Gly	Ala	Ile	Asn	Glu	Ile	Glu
	130					135				140					
Tyr	Glu	Asn	Ile	Arg	Ser	Ile	Glu	Leu	Ser	Lys	Gly	Ala	Ser	Ser	Ala
145					150					155				160	
Glu	Tyr	Gly	Ser	Gly	Ala	His	Gly	Gly	Ala	Ile	Gly	Phe	Arg	Thr	Lys
			165						170					175	
Asp	Ala	Gln	Asp	Ile	Ile	Lys	Glu	Gly	Gln	His	Trp	Gly	Leu	Asp	Ser

97

180 185 190
Lys Thr Ser Tyr Ala Ser Lys Asn Ser His Phe Leu Gln Ile Ala Ala
195 200 205
Ala Gly Glu Ala Gly Gly Phe Glu Ala Leu Val Ile Ala Thr His Arg
210 215 220
His Gly Lys Glu Thr Lys Ile His Ser Glu Ala Asn Lys Leu Lys His
225 230 235 240
Asn Ile Arg Arg Ile Thr Gly Phe Glu Asn Arg Tyr Asp Phe Thr Gln
245 250 255
Ile Pro His Arg Met Pro Pro Gly Gly Ser Phe Phe Ile Val Glu Asp
260 265 270
Thr Cys Pro Thr Leu Asp Cys Thr Pro Arg Ala Arg Val Lys Leu Asn
275 280 285
Arg Asp Asn Phe Pro Val Arg Thr Phe Pro Glu Tyr Thr Pro Glu Glu
290 295 300
Arg Asn Ala Glu Gln Ile Pro Tyr Arg Thr Glu Gln Leu Ser Ala Gln
305 310 315 320
Glu Lys Thr Gly Lys Asp Arg Ile Ala Pro Asn Pro Leu Asp Tyr Lys
325 330 335
Ser Asn Ser Val Phe Met Lys Phe Gly Tyr His Phe Asn Ser Ser His
340 345 350
Tyr Leu Gly Ala Ile Leu Glu Asp Thr Lys Gln Arg Thr Ile Ser Val
355 360 365
Ile Cys Lys Arg Gln Leu Thr Ile Gln Lys Thr Ile Leu Thr Tyr His
370 375 380
Leu Gly Thr Met Phe Met Lys Gly Ile Ile Phe Arg Trp Leu Ser Val
385 390 395 400
Gln Ala Lys Asp Pro Leu Trp Val Ala His Met Pro Cys Glu Val Asp
405 410 415
Glu Arg His His Lys Arg Arg Leu Gly Phe Thr Tyr Lys Tyr Lys Pro
420 425 430
Glu Asn Asn Arg Trp Leu Asp Ser Ile Asn Ser Cys Val Arg Ala Leu
435 440 445
Arg Ser Arg Cys Cys Ala Leu Ser Lys Gln Asp Ile Glu Leu Tyr Ser
450 455 460
Arg Leu His Arg Leu His Cys Ser Asp Tyr Pro Val Val Asp Lys Asn
465 470 475 480
Cys Gly Pro Thr Leu Asp Lys Ser Trp Ser Met Tyr Arg Thr Glu Arg
485 490 495
Asn Asn Tyr Gln Glu Lys Ala Thr Cys His Ser Phe Cys Ile Leu Lys
500 505 510
Ala Leu Asn Ala Gly Gln Gly Val Phe Lys Gln Thr His Lys Leu Asn
515 520 525
Leu Gly Leu Gly Phe Glu Ser Asn Leu Ile Arg Leu Thr Ile Ile Gly
530 535 540
Ile Ile Leu Pro Asn Ile Pro Lys Ala Gly Tyr Thr Ser Tyr Arg Gly
545 550 555 560
Arg Gly Arg Leu Asp Asn Pro Tyr Ile Tyr Arg Arg Asp Pro Arg Ser
565 570 575
Ile Glu Thr Val Ser Leu Cys Asn Asn Thr Arg Ala Thr Leu Leu Leu
580 585 590
Leu Arg Val Asn Lys Gly Ile Arg Leu Leu Leu Arg
595 600

98

<210> 14
<211> 593
<212> PRT
<213> Pasteurella haemolytica

<400> 14
Met His Phe Lys Leu Asn Pro Tyr Ala Leu Ala Phe Thr Ser Leu Phe
1 5 10 15
Leu Val Ala Cys Ser Gly Gly Lys Gly Ser Phe Asp Leu Glu Asp Val
20 25 30
Arg Pro Asn Gln Thr Ala Lys Ala Glu Lys Ala Thr Thr Ser Tyr Gln
35 40 45
Asp Glu Glu Thr Lys Lys Lys Thr Lys Glu Glu Leu Asp Lys Leu Met
50 55 60
Glu Pro Ala Leu Gly Tyr Glu Thr Gln Ile Leu Arg Arg Asn Lys Ala
65 70 75 80
Pro Lys Thr Glu Thr Gly Glu Lys Arg Asn Glu Arg Val Val Glu Leu
85 90 95
Ser Glu Asp Lys Ile Thr Lys Leu Tyr Gln Glu Ser Val Glu Ile Ile
100 105 110
Pro His Leu Asp Glu Leu Asn Gly Lys Thr Thr Ser Asn Asp Val Tyr
115 120 125
His Ser His Asp Ser Lys Arg Leu Asp Lys Asn Arg Asp Leu Lys Tyr
130 135 140
Val Arg Ser Gly Tyr Val Tyr Asp Gly Ser Phe Asn Glu Ile Arg Arg
145 150 155 160
Asn Asp Ser Gly Phe His Val Phe Lys Gln Gly Ile Asp Gly Tyr Val
165 170 175
Tyr Tyr Leu Gly Val Thr Pro Ser Lys Glu Leu Pro Lys Gly Lys Val
180 185 190
Ile Ser Tyr Lys Gly Thr Trp Asp Phe Val Ser Asn Ile Asn Leu Glu
195 200 205
Arg Glu Ile Asp Gly Phe Asp Thr Ser Gly Asp Gly Lys Asn Val Ser
210 215 220
Ala Thr Ser Ile Thr Glu Thr Val Asn Arg Asp His Lys Val Gly Glu
225 230 235 240
Lys Leu Gly Asp Asn Glu Val Lys Gly Val Ala His Ser Ser Glu Phe
245 250 255
Ala Val Asp Phe Asp Asn Lys Lys Leu Thr Gly Ser Leu Tyr Arg Asn
260 265 270
Gly Tyr Ile Asn Arg Asn Lys Ala Gln Glu Val Thr Lys Arg Tyr Ser
275 280 285
Ile Glu Ala Asp Ile Ala Gly Asn Arg Phe Arg Gly Lys Ala Lys Ala
290 295 300
Glu Lys Ala Gly Asp Pro Ile Phe Thr Asp Ser Asn Tyr Leu Glu Gly
305 310 315 320
Gly Phe Tyr Gly Pro Lys Ala Glu Glu Met Ala Gly Lys Phe Phe Thr
325 330 335
Asn Asn Lys Ser Leu Phe Ala Val Phe Ala Ala Lys Ser Glu Asn Gly
340 345 350
Glu Thr Thr Thr Glu Arg Ile Ile Asp Ala Thr Lys Ile Asp Leu Thr

gg

355 360 365
Gln Phe Asn Ala Lys Glu Leu Asn Asn Phe Gly Asp Ala Ser Val Leu
370 375 380
Ile Ile Asp Gly Gln Lys Ile Asp Leu Ala Gly Val Asn Phe Lys Asn
385 390 395 400
Ser Lys Thr Val Glu Ile Asn Gly Lys Thr Met Val Ala Val Ala Cys
405 410 415
Cys Ser Asn Leu Glu Tyr Met Lys Phe Gly Gln Leu Trp Gln Lys Glu
420 425 430
Gly Lys Gln Gln Val Lys Asp Asn Ser Leu Phe Leu Gln Gly Glu Arg
435 440 445
Thr Ala Thr Asp Lys Met Pro Ala Gly Gly Asn Tyr Lys Tyr Val Gly
450 455 460
Thr Trp Asp Ala Leu Val Ser Lys Gly Thr Asn Trp Ile Ala Glu Ala
465 470 475 480
Asp Asn Asn Arg Glu Ser Gly Tyr Arg Thr Glu Phe Asp Val Asn Phe
485 490 495
Ser Asp Lys Lys Val Asn Gly Lys Leu Phe Asp Lys Gly Gly Val Asn
500 505 510
Pro Val Phe Thr Val Asp Ala Thr Ile Asn Gly Asn Gly Phe Ile Gly
515 520 525
Ser Ala Lys Thr Ser Asp Ser Gly Phe Ala Leu Asp Ala Gly Ser Ser
530 535 540
Gln His Gly Asn Ala Val Phe Ser Asp Ile Lys Val Asn Gly Gly Phe
545 550 555 560
Tyr Gly Pro Thr Ala Gly Glu Leu Gly Gly Gln Phe His His Lys Ser
565 570 575
Asp Asn Gly Ser Val Gly Ala Val Phe Gly Ala Lys Arg Gln Ile Glu
580 585 590
Lys

<210> 15
<211> 547
<212> PRT
<213> Pasteurella haemolytica

<400> 15
Met His Phe Lys Leu Asn Pro Tyr Ala Leu Ala Phe Thr Ser Leu Phe
1 5 10 15
Leu Val Ala Cys Ser Gly Gly Lys Gly Ser Phe Asp Leu Glu Asp Val
20 25 30
Arg Pro Asn Lys Thr Thr Gly Val Ser Lys Glu Glu Tyr Lys Asp Val
35 40 45
Glu Thr Ala Lys Lys Glu Lys Glu Gln Leu Gly Glu Leu Met Glu Pro
50 55 60
Ala Leu Gly Tyr Val Val Lys Val Pro Val Ser Phe Glu Asn Lys
65 70 75 80
Lys Val Asp Ile Ser Asp Ile Glu Val Ile Thr Asn Gly Asn Leu Asp
85 90 95
Asp Val Pro Tyr Lys Ala Asn Ser Ser Lys Tyr Asn Tyr Pro Asp Ile
100 105 110

100

Lys	Thr	Lys	Asp	Ser	Ser	Leu	Gln	Tyr	Val	Arg	Ser	Gly	Tyr	Val	Ile
		115					120					125			
Asp	Gly	Glu	His	Ser	Gly	Ser	Asn	Glu	Lys	Gly	Tyr	Val	Tyr	Tyr	Lys
	130					135					140				
Gly	Asn	Ser	Pro	Ala	Lys	Glu	Leu	Pro	Val	Asn	Gln	Leu	Leu	Thr	Tyr
145					150					155					160
Thr	Gly	Ser	Trp	Asp	Phe	Thr	Ser	Asn	Ala	Asn	Leu	Asn	Asn	Glu	Glu
				165					170					175	
Gly	Arg	Pro	Asn	Tyr	Leu	Asn	Asp	Asp	Tyr	Tyr	Thr	Lys	Phe	Ile	Gly
			180					185					190		
Lys	Arg	Val	Gly	Leu	Val	Ser	Gly	Asp	Ala	Lys	Pro	Ala	Lys	His	Lys
		195					200					205			
Tyr	Thr	Ser	Gln	Phe	Glu	Val	Asp	Phe	Ala	Thr	Lys	Lys	Met	Thr	Gly
	210					215					220				
Lys	Leu	Ser	Asp	Lys	Glu	Lys	Thr	Ile	Tyr	Thr	Val	Asn	Ala	Asp	Ile
225					230					235					240
Arg	Gly	Asn	Arg	Phe	Thr	Gly	Ala	Ala	Thr	Ala	Ser	Asp	Lys	Asn	Lys
				245					250					255	
Gly	Lys	Gly	Glu	Ser	Tyr	Asn	Phe	Phe	Ser	Ala	Asp	Ser	Gln	Ser	Leu
			260					265					270		
Glu	Gly	Gly	Phe	Tyr	Gly	Pro	Lys	Ala	Glu	Glu	Met	Ala	Gly	Lys	Phe
		275					280					285			
Val	Ala	Asn	Asp	Lys	Ser	Leu	Phe	Ala	Val	Phe	Ser	Ala	Lys	His	Asn
	290					295					300				
Gly	Ser	Asn	Val	Asn	Thr	Val	Arg	Ile	Ile	Asp	Ala	Ser	Lys	Ile	Asp
305					310					315					320
Leu	Thr	Asn	Phe	Ser	Ile	Ser	Glu	Leu	Asn	Asn	Phe	Gly	Asp	Ala	Ser
				325					330					335	
Val	Leu	Ile	Ile	Asp	Gly	Lys	Lys	Ile	Lys	Leu	Ala	Gly	Ser	Gly	Phe
			340					345					350		
Thr	Asn	Lys	His	Thr	Ile	Glu	Ile	Asn	Gly	Lys	Thr	Met	Val	Ala	Val
		355					360					365			
Ala	Cys	Cys	Ser	Asn	Leu	Glu	Tyr	Met	Lys	Phe	Gly	Gln	Leu	Trp	Gln
	370					375					380				
Gln	Ala	Glu	Gly	Gly	Lys	Pro	Glu	Asn	Asn	Ser	Leu	Phe	Leu	Gln	Gly
385					390					395					400
Glu	Arg	Thr	Ala	Thr	Asp	Lys	Met	Pro	Lys	Gly	Gly	Asn	Tyr	Lys	Tyr
				405					410					415	
Ile	Gly	Thr	Trp	Asp	Ala	Gln	Val	Ser	Lys	Glu	Asn	Asn	Trp	Val	Ala
			420					425					430		
Thr	Ala	Asp	Asp	Asp	Arg	Lys	Ala	Gly	Tyr	Arg	Thr	Glu	Phe	Asp	Val
		435					440					445			
Asp	Phe	Gly	Asn	Lys	Asn	Leu	Ser	Gly	Lys	Leu	Phe	Asp	Lys	Asn	Gly
	450					455					460				
Val	Asn	Pro	Val	Phe	Thr	Val	Asp	Ala	Lys	Ile	Asp	Gly	Asn	Gly	Phe
465					470					475					480
Thr	Gly	Lys	Ala	Lys	Thr	Ser	Asp	Glu	Gly	Phe	Ala	Leu	Asp	Ser	Gly
				485					490					495	
Ser	Ser	Arg	Tyr	Glu	Asn	Val	Lys	Phe	Asn	Asp	Val	Ala	Val	Ser	Gly
			500					505					510		
Gly	Phe	Tyr	Gly	Pro	Thr	Ala	Ala	Glu	Leu	Gly	Gly	Gln	Phe	His	His
	515						520					525			
Lys	Ser	Glu	Asn	Gly	Ser	Val	Gly	Ala	Val	Phe	Gly	Ala	Lys	Gln	Gln

530
Val Lys Lys
545

535

540

<210> 16
<211> 64
<212> PRT
<213> Pasteurella haemolytica

<400> 16
Asp Glu Val Ile Val Thr Glu Tyr Ala Ile Arg Gly Val Asp Lys Asn
1 5 10 15
Arg Val Ser Leu Leu Val Asp Gly Ile Glu Leu Ser Lys Gly Ala Ser
20 25 30
Ser Ala Glu Tyr Gly Ser Gly Ala His Gly Gly Ala Ile Gly Phe Arg
35 40 45
Thr Lys Asp Phe Lys Gln Thr His Lys Leu Asn Leu Gly Leu Gly Phe
50 55 60

<210> 17
<211> 64
<212> PRT
<213> Pasteurella haemolytica

<400> 17
Glu Thr Met Val Val Thr Ala Val Ser Ile Arg Gly Leu Asp Ser Ser
1 5 10 15
Tyr Thr Leu Ile Leu Val Asp Gly Ile Glu Val Val Arg Gly Pro Met
20 25 30
Ser Ser Leu Tyr Gly Ser Asp Ala Leu Gly Gly Val Val Asn Ile Ile
35 40 45
Thr Lys Lys Pro Glu Thr Ser Glu Ser Trp Glu Leu Gly Leu Tyr Tyr
50 55 60

<210> 18
<211> 64
<212> PRT
<213> Pasteurella haemolytica

<400> 18
Asp Thr Ile Val Val Thr Ala Ile Asp Ile Arg Gly Met Gly Pro Glu
1 5 10 15
Asn Thr Leu Ile Leu Ile Asp Gly Ile Glu Val Leu Arg Gly Pro Ala
20 25 30
Arg Ala Arg Tyr Gly Asn Gly Ala Ala Gly Gly Val Val Asn Ile Ile
35 40 45
Thr Lys Lys Ala Glu Thr Ser Ile Asn Lys Glu Ile Gly Leu Glu Phe
50 55 60

102

<210> 19
<211> 64
<212> PRT
<213> Pasteurella haemolytica

<400> 19
Asp Thr Ile Thr Val Thr Ala Leu Ile Ile Arg Gly Phe Ala Ala Glu
1 5 10 15
Gly Gln Asn Asn Tyr Leu Asn Gly Ala Glu Ile Met Arg Gly Pro Val
20 25 30
Ser Val Leu Tyr Gly Lys Ser Ser Pro Gly Gly Leu Leu Asn Met Val
35 40 45
Ser Lys Arg Pro Ser Lys Gly Lys Gln Tyr Glu Val Gly Val Lys Tyr
50 55 60

<210> 20
<211> 67
<212> PRT
<213> Pasteurella haemolytica

<400> 20
Phe Thr Leu Ser Val Asp Ala Phe Gly Ile Arg Gly Leu Asn Pro Arg
1 5 10 15
Leu Thr Ser Arg Ser Thr Val Leu Met Asp Gly Ile Asp Val Val Arg
20 25 30
Gly Gly Gly Ala Val Arg Tyr Gly Pro Gln Ser Val Gly Gly Val Val
35 40 45
Asn Phe Val Thr Arg Ala Pro Glu Lys Ala Arg Thr Trp Glu Leu Gly
50 55 60
Thr Arg Tyr
65

<210> 21
<211> 330
<212> DNA
<213> Pasteurella haemolytica

<400> 21
attttttatc taatctaaaa acaagcggtt ccaccttgga aatgattaac atgacacctga 60
aactaataaa gttcaaacct ttacattaag tttatattat aaattataat gattattatt 120
ttataaatta aaggagacat tatgtttaaa cttaaaagta gttttgtact ggaaaaataa 180
tcataattcc ctttgctgg ttgtagatag caagcgggca attttttata aaaatttgca 240
aaatttaa ataaaggagacc ctatcta ataatgaa atcatcatt tcgcagaaat 300
ttcagtttag catttgaaat gaagttttag 330

<210> 22
<211> 32
<212> DNA
<213> Pasteurella haemolytica

<400> 22

103

ggaagcttac tgaaaataaa aaaatcgaag aa 32

<210> 23
<211> 21
<212> DNA
<213> Pasteurella haemolytica

<400> 23
ggaattcccg tcctgtggat c 21

<210> 24
<211> 22
<212> DNA
<213> Pasteurella haemolytica

<400> 24
gtgaattccg gcgtagagga tc 22

<210> 25
<211> 32
<212> DNA
<213> Pasteurella haemolytica

<400> 25
ggaagcttac tgaaaataaa aaaatcgaag aa 32

<210> 26
<211> 20
<212> DNA
<213> Pasteurella haemolytica

<400> 26
cactactttc cccaagccag 20

<210> 27
<211> 20
<212> DNA
<213> Pasteurella haemolytica

<400> 27
ggaattccct cctgtggatc 20

<210> 28
<211> 19
<212> DNA
<213> Pasteurella haemolytica

<400> 28
gcgcgcgccg aatcttatc 19

<210> 29
<211> 20
<212> DNA

<213> Pasteurella haemolytica

<400> 29

caaagcttgc tgtctcgagg

20

<210> 30

<211> 28

<212> DNA

<213> Pasteurella haemolytica

<400> 30

agatctggat tctaaatcag accgcttg

28

<210> 31

<211> 21

<212> DNA

<213> Pasteurella haemolytica

<400> 31

gttaagcggg gttcttatcg g

21

<210> 32

<211> 29

<212> DNA

<213> Pasteurella haemolytica

<400> 32

taaattaaag gagacattat gtttaaact

29

<210> 33

<211> 36

<212> DNA

<213> Pasteurella haemolytica

<400> 33

cgacgcccat gggtattttt ctatttgacg ttttcc

36

<210> 34

<211> 28

<212> DNA

<213> Pasteurella haemolytica

<400> 34

gcgcaagctt ttatttttct atttgacg

28

<210> 35

<211> 39

<212> DNA

<213> Pasteurella haemolytica

<400> 35

ggattcagat cttaaaggag accctatcta atgataatg

39

105

<210> 36
<211> 28
<212> DNA
<213> Pasteurella haemolytica

<400> 36
ccctatcata tgataatgaa atatcatc

28

<210> 37
<211> 31
<212> DNA
<213> Pasteurella haemolytica

<400> 37
tagcgcaagc ttctaaaact tcatttcaaa t

31

<210> 38
<211> 5
<212> PRT
<213> Pasteurella haemolytica

<400> 38
Tyr Lys Gly Tyr Trp
1 5

<210> 39
<211> 5
<212> PRT
<213> Pasteurella haemolytica

<400> 39
Tyr Arg Gly Thr Trp
1 5

<210> 40
<211> 8
<212> PRT
<213> Pasteurella haemolytica

<400> 40
Phe Thr Ala Asp Phe Ala Asn Lys
1 5

<210> 41
<211> 8
<212> PRT
<213> Pasteurella haemolytica

<400> 41
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106

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<400> 42
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